$\boxed{P.1}$

$\rho = 5 \cdot 10^{-3} \left[Kg/m \right]$

$L = 2 [m]$

9 Kg:

$C = \sqrt{\frac{9 \cdot 10}{5 \cdot 10^{-3}}} = \sqrt{\frac{9}{5}} \cdot 100 \left[\frac{m}{s}\right] = \frac{3}{\sqrt{5}} 100 \left[\frac{m}{s}\right]$

16 Kg

$C = \sqrt{\frac{16}{5}} 100 \left[\frac{m}{s}\right] = \frac{4}{\sqrt{5}} 100 \frac{m}{s}$

① $f = \frac{3}{\sqrt{5}} 100 \frac{1}{4 \cdot 2} \cdot n_1$

② $f = \frac{4}{\sqrt{5}} 100 \frac{1}{4 \cdot 2} \cdot n_2$

$3 n_1 = 4 n_2$

$n_1 = \frac{4}{3} n_2$

$n_2 = 3 \Rightarrow n_1 = 4$ //

$f = \frac{3}{2\sqrt{5}} \cdot 100 \left[Hz \right]$ //

P2

$T = 10 [N]$

$\rho = 100 [gr/m] = 0{,}1 [Kg/m]$

$c = \sqrt{\frac{10}{0{,}1}} = 10 \left[\frac{m}{seg}\right]$ $\Rightarrow$ $f = \frac{c}{\lambda} = \frac{10}{0{,}2} [Hz] = 50 [Hz]$

$A = 2 [cm] = 0{,}02 [m]$

$\lambda = 0{,}2 [m]$

$\omega = 2\pi f = 100\pi \left[\frac{Rad}{seg}\right]$

$k = \frac{2\pi}{\lambda} = \frac{2\pi}{0{,}2} = 10\pi \left[\frac{1}{m}\right]$

$y(x,t) = 2A \operatorname{sen}(kx) \cos(\omega t)$

$\Rightarrow y(x,t) = 0{,}04 \cdot \operatorname{sen}(10\pi x) \cos(100\pi t)$

- Determinar L

$10\cancel{\pi} x_0 = n\cancel{\pi} \Rightarrow x_0 = \frac{n}{10}$

$10\cancel{\pi} x_1 = (n+1)\cancel{\pi} \Rightarrow x_1 = \frac{n+1}{10}$

$L = x_1 - x_0 = \cancel{\frac{n}{10}} + \frac{1}{10} - \cancel{\frac{n}{10}} = 0{,}1 [m]$ //

- Maxima Altura a la que llega A

$A_{max} = 0{,}04 [m]$

- Tiempo en que A llega a ser maximo

Si A es antinodo $\Rightarrow$ $\operatorname{Sen}(10\pi x) = 1$
y por lo tanto para A:

$$y(x_A, t) = 0{,}04 \cos(100\pi t)$$

en t_0:

$$\cos(100\pi t_0) = \frac{0{,}02}{0{,}04} = \frac{1}{2}$$

$$100\pi t_0 = \frac{5\pi}{3} \Rightarrow t_0 = \frac{1}{60}\,[\text{seg}]$$

en t_1:

$$\cos(100\pi t_1) = 1$$

$$100\pi t_1 = 2\pi \Rightarrow t_1 = \frac{1}{50}\,[\text{seg}]$$

$$\Delta t = \frac{1}{50} - \frac{1}{60} = \frac{1}{300}\,[\text{seg}]$$

P.3

$L = 0{,}2\,[m]$

$m = 0{,}3\,[kg]$ $\qquad I = \frac{1}{12}\,0{,}3\cdot(0{,}2)^2 = 10^{-3}$

$\Delta = 0{,}01\,[m]$

$$c = \sqrt{\frac{T\cdot 10^{-4}}{10^{-3}}} = \sqrt{\frac{T}{10}}$$

$$\theta(x,t) = A\,e^{-(ax+bt)^2} = A\,e^{-(a(x+\frac{b}{a}t))^2}$$

$\Rightarrow$ • Direccion como el termino $x+ct$ tiene signo + viaja a la izquierda

• $c = \frac{b}{a} = \frac{0{,}05\,(s^{-1})}{1\,(m^{-1})} = 0{,}05\left[\frac{m}{s}\right]$

• $\sqrt{\frac{T}{10}} = 5\cdot 10^{-2} \Rightarrow T = 25\cdot 10^{-4}\cdot 10\,[N\cdot m] = 0{,}025\,[N\,m]$

Resumen

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{c^2}\frac{\partial y^2}{\partial t^2}$$

$$k = \frac{2\pi}{\lambda}$$

$$\omega = \frac{2\pi}{T}$$

$$u(x,t) = f(x-ct) + g(x+ct)$$

$$c = \frac{\lambda}{T} = \lambda f = \frac{\omega}{k}$$

$$y(x,t) = A \operatorname{sen}(kx - \omega t)$$

onda estacionaria:

$$y(x,t) = 2A \operatorname{sen}(kx)\cos(\omega t)$$

cuerda: $c = \sqrt{\frac{T}{\rho}}$

barras: $c = \sqrt{\frac{T\Delta^2}{I}}$

extremo fijo

$$y(L,t) = 0 \quad \forall t$$

$$2A \operatorname{sen}(kL)\cos(\omega t) = 0 \quad \forall t$$

$$\Rightarrow kL = n\pi$$

$$\frac{2\pi}{\lambda} = \frac{n\pi}{L}$$

$$\lambda = \frac{2L}{n}$$

extremo libre

$$\frac{\partial y}{\partial x}(L,t) = 0 \quad \forall t$$

$$2A\cos(kL)\cos(\omega t) = 0$$

$$kL = \frac{\pi}{2} + n\pi = \frac{\pi}{2}(1+2n)$$

$$\frac{2\pi}{\lambda} = \frac{\pi}{2}(1+2n)$$